OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **CLEMENT POND** the program coordinators recommend the following actions.

FIGURE INTERPRETATION

- Figure 1: These graphs illustrate concentrations of chlorophyll-a in the water column. Algae are microscopic plants that are a natural part of lake ecosystems. Algae contain chlorophyll-a, a pigment necessary for photosynthesis. A measure of chlorophyll-a can indicate the abundance of algae in a lake. The historical data (the bottom graph) show a *slightly increasing* in-lake chlorophyll-a trend. Concentrations have been increasing since 1997. The reference line shows a decreasing trend, but is skewed by the high results recorded in 1991. Last year's increased concentration during September was not revisited, and actually this September's result was less than the other summer months. The results from this season were consistent with those of last season but were still slightly elevated from the results observed since 1993. This season's average chlorophyll-a concentration continues to remain below the state mean. While algae are present in all lakes, an excess amount of any type is not welcomed. Concentrations can increase when there are external and internal sources of phosphorus, which is the nutrient algae depend upon for growth. It's important to continue the education process and keep residents aware of the sources of phosphorus and how it influences lake quality.

- Figure 2: Water clarity is measured by using a Secchi disk. Clarity, or transparency, can be influenced by such things as algae, sediments from erosion, and natural colors of the water. The graphs on this page show historical and current year data. The lower graph shows a *stable* trend in lake transparency. The decrease in clarity experienced in June was most likely a result of the windy conditions. Waves and ripples can make viewing the Secchi disk more difficult than a calm surface. Clarity readings actually increased throughout the summer, with the September reading above the New Hampshire mean. The average clarity for Clement Pond was below the state mean and was lower than the 1999 mean. The 2000 sampling season was considered to be wet and, therefore, average transparency readings are expected to be slightly lower than last year's readings.

Higher amounts of rainfall usually cause more eroding of sediments into the lake and streams, thus decreasing clarity.

- Figure 3: These figures show the amounts of phosphorus in the epilimnion (the upper layer in the lake) and the hypolimnion (the lower layer); the inset graphs show current year data. Phosphorus is the limiting nutrient for plants and algae in New Hampshire waters. Too much phosphorus in a lake can lead to increases in plant growth over time. These graphs show a *stable* trend for in-lake phosphorus levels. The epilimnion experienced an increase in mean total phosphorus concentrations since 1998, yet remains below the state median. In contrast, the hypolimnetic average was much lower than in 1999, but is still above the state median. There was an increase in phosphorus levels towards the end of the season in both the upper and lower water layers of the pond. The high concentration of phosphorus in the hypolimnion in September could be a result of internal phosphorus loading. As oxygen is depleted in the lower water layer it can cause an internal source of phosphorus to be released from the sediments into the water column. One of the most important approaches to reducing phosphorus levels is educating the public. Humans introduce phosphorus to lakes by several means: fertilizing lawns, septic system failures, and detergents containing phosphates are just a few. Keeping the public aware of ways to reduce the input of phosphorus to lakes means less productivity in the lake. Contact the VLAP coordinator for tips on educating your lake residents or for ideas on testing your watershed for phosphorus inputs.

OTHER COMMENTS

- The diatoms *Asterionella and Rhizosolenia* dominated the plankton sample in July (Table 2). Diatoms are the most common plankton in New Hampshire's waters. The problematic blue-green algae were at a low concentration this summer.

- The mean Acid Neutralizing Capacity (ANC) in Clement Pond has remained in the highly sensitive range since the pond was first monitored by VLAP in 1991. Many of the lakes and ponds in New Hampshire experience even lower ANC values on a regular basis. This means Clement Pond is less affected by acidic inputs than most lakes in New Hampshire.

- The conductivity levels of most of the sampling sites at Clement Pond were only slightly elevated this year (Table 6). It is possible that with the increased rain in during the 2000 summer season resulted in a greater load of pollutants to the pond and the Hopkinton Inlet. Overall, the conductivity values in the watershed remain very low and are not considered to be at nuisance levels at this point in time.

- The Hopkinton Inlet mean total phosphorus was reduced in 2000 from the 1999 season (Table 8). We will continue to monitor the conditions of this Inlet in the future. The mean results for this inlet have been extremely variable since 1991. Be sure to sample the Inlet during high flow periods, if possible. When the Inlet is not flowing or there is little water present please indicate the conditions on your Field Data Sheet.

- Dissolved oxygen was again low at the bottom three meters of the pond in July (Table 9). This did not appear to influence the total phosphorus results in that month. While it is possible there was a problem with the meter, this pond has historically had low oxygen concentrations during the latter part of the summer. This may explain the higher total phosphorus concentrations in September, as was discussed in the Figure Interpretations section above.

USEFUL RESOURCES

A Brief History of Lakes, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

Anthropogenic Phosphorus and New Hampshire Waterbodies, NHDES-WSPCD-95-6, NHDES Booklet, (603) 271-3503

Handle With Care: Your Guide to Preventing Water Pollution. Terrene Institute, 1991. (703) 661-1582.

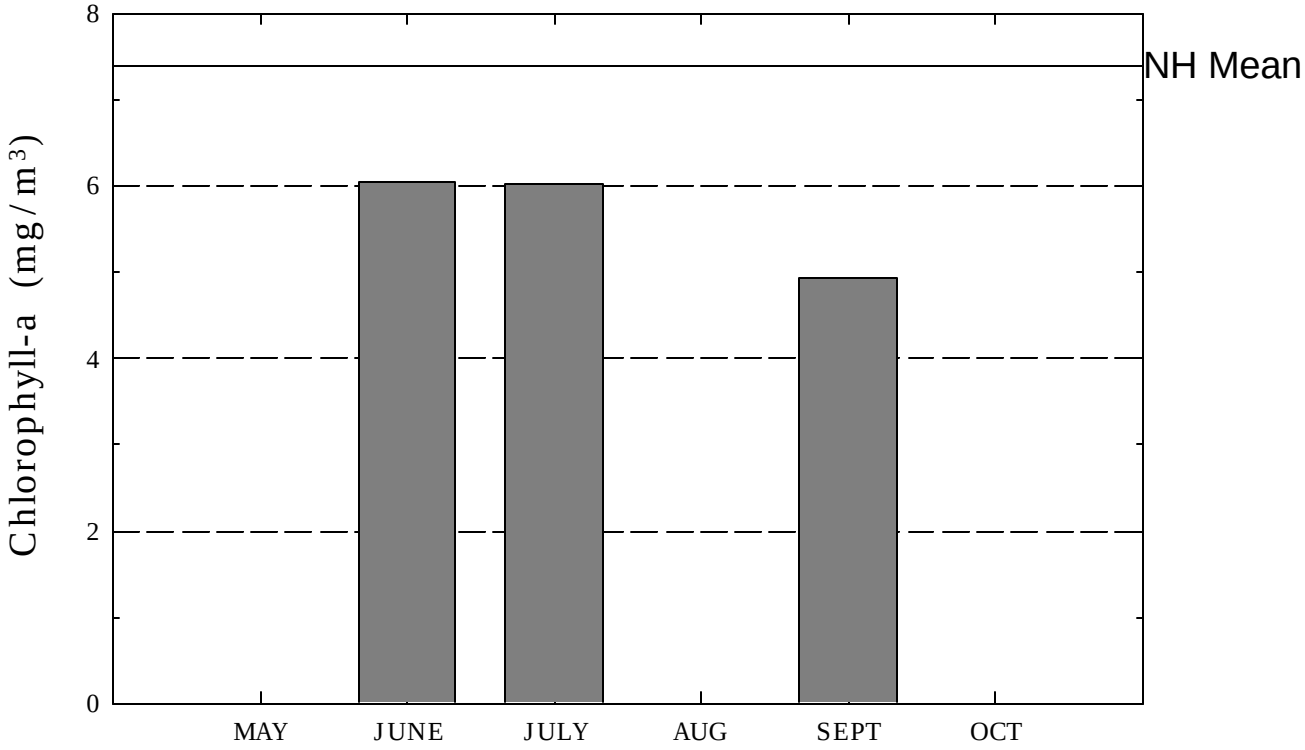
Guidelines for the Standard Application Process for Wetlands Impacts, WD-WB-8, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

Answers to Common Lake Questions, NHDES-WSPCD-92-12, NHDES Booklet, (603) 271-3503.

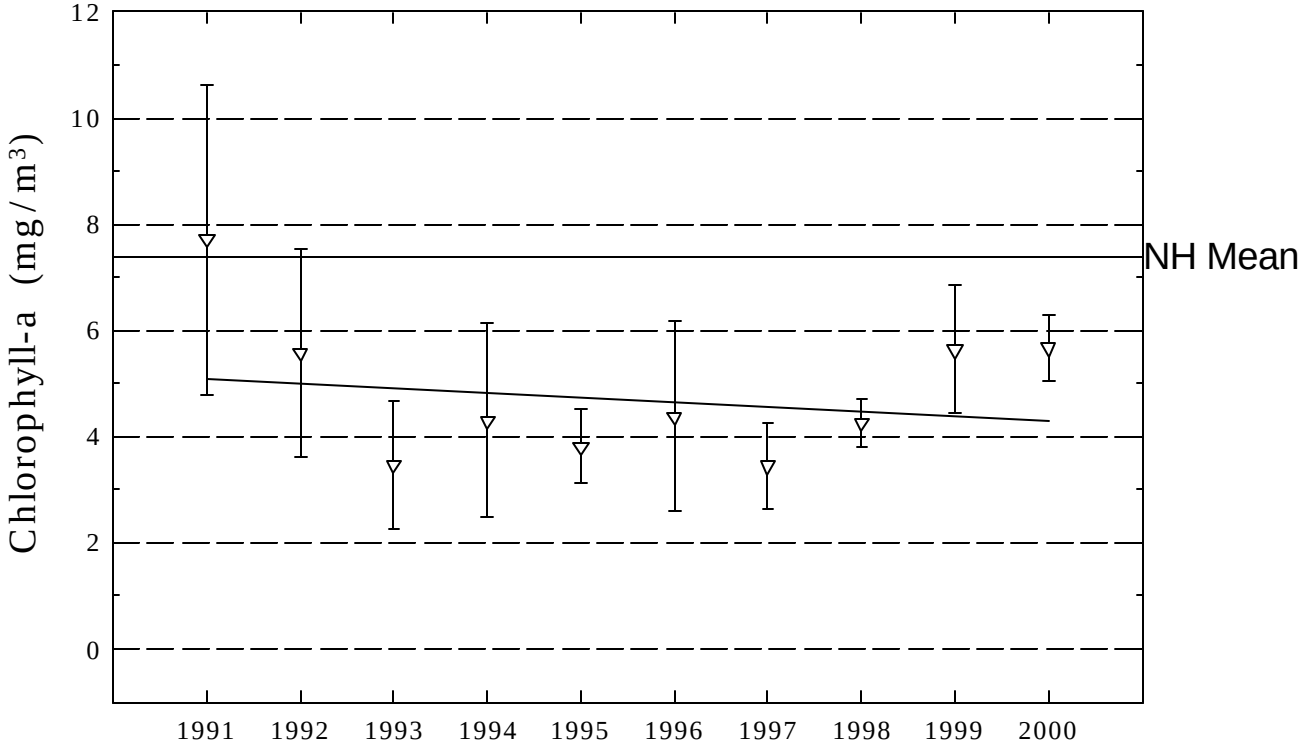
*Low Impact Boatin*g, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

Clement Pond

Figure 1. Monthly and Historical Chlorophyll-a Results



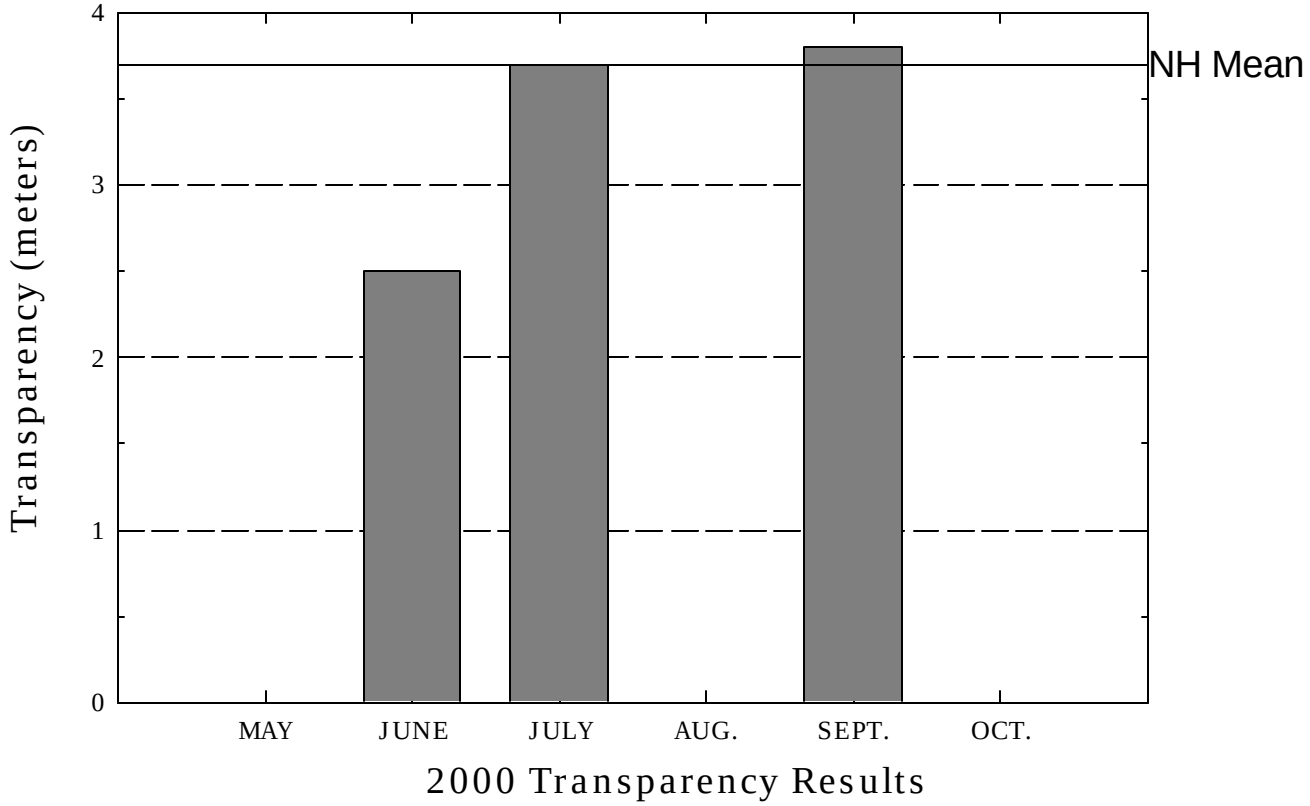
2000 Chlorophyll-a Results

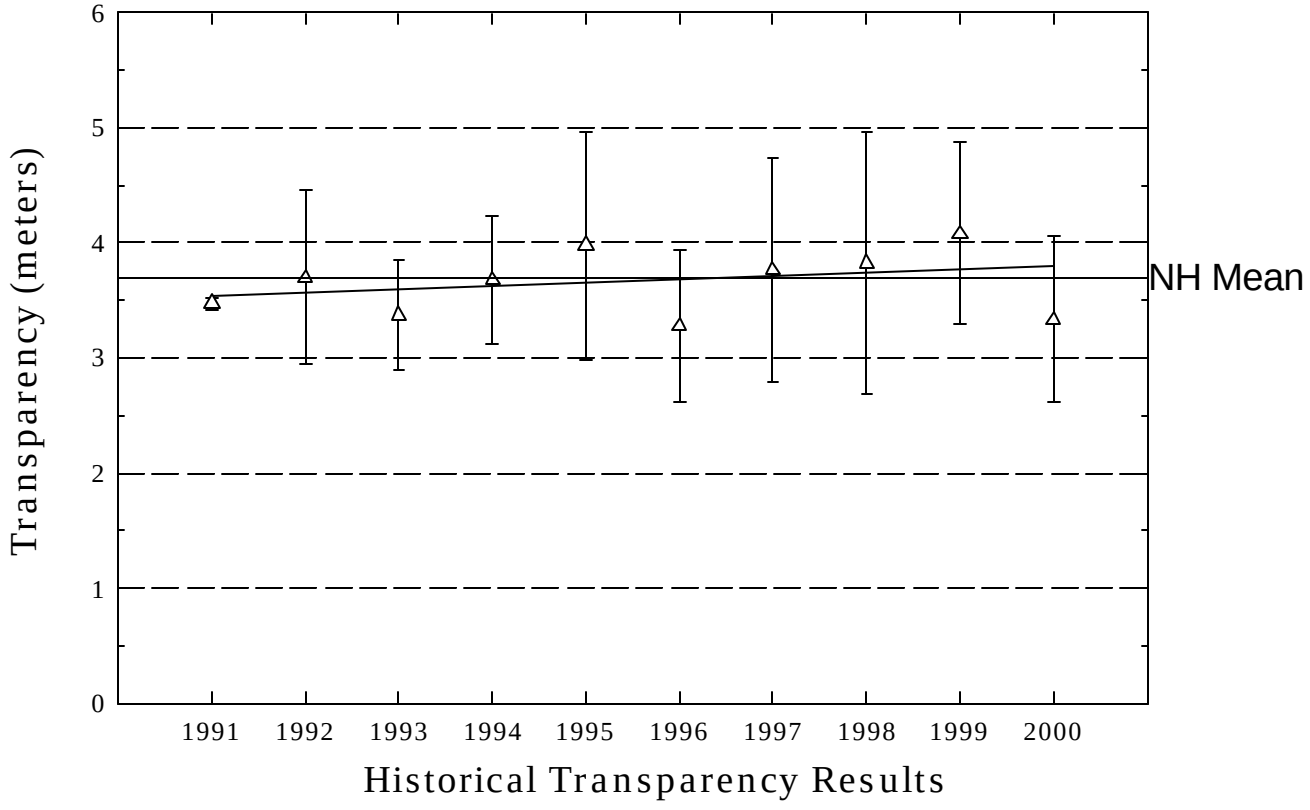


Historical Chlorophyll-a Results

Clement Pond

Figure 2. Monthly and Historical Transparency Results





Clement Pond

Figure 3. Monthly and Historical Total Phosphorus Data.

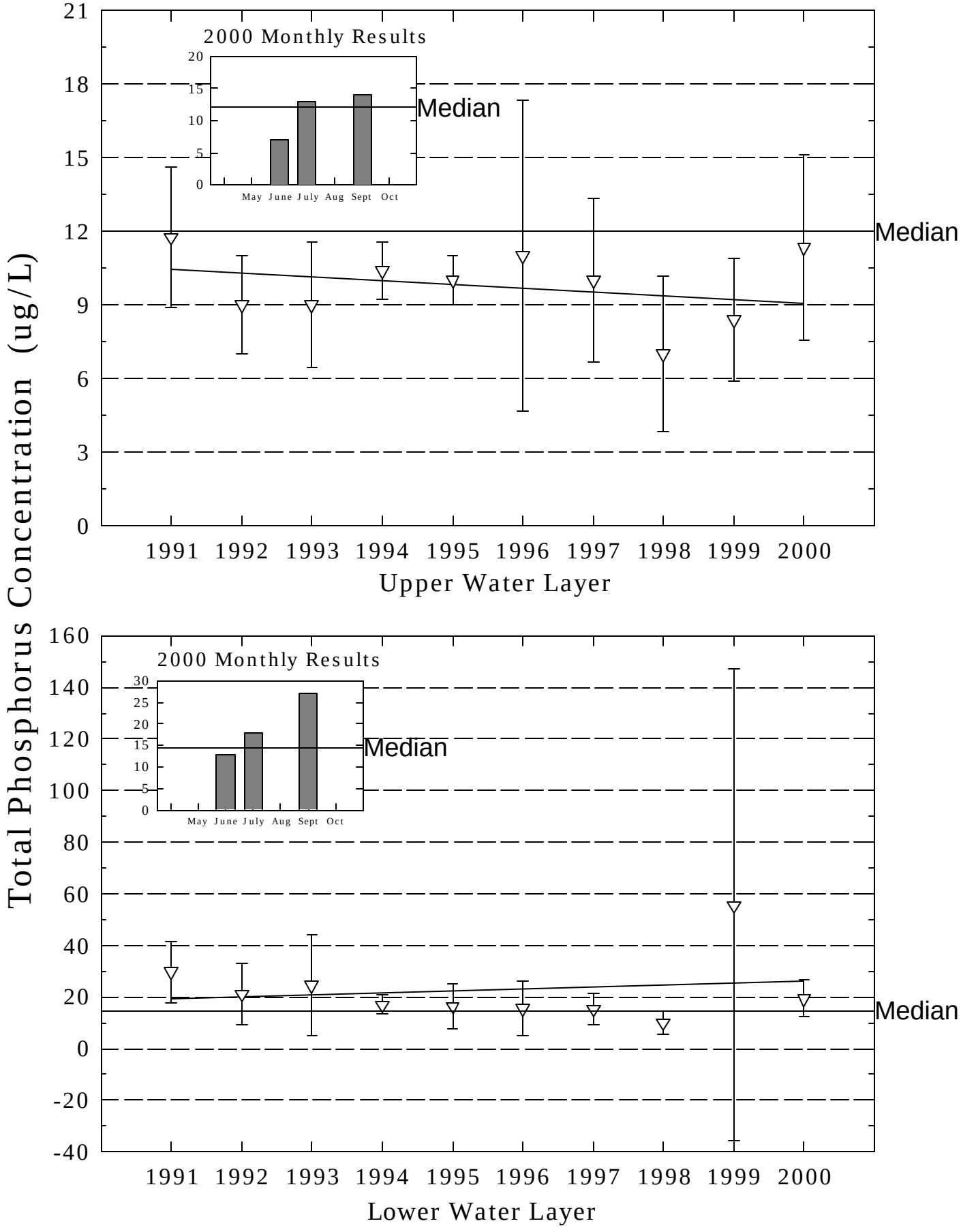


Table 1.

CLEMENT POND

HOPKINTON

Chlorophyll-a results (mg/m^3) for current year and historical sampling periods.

Year	Minimum	Maximum	Mean
1991	5.48	11.73	7.71
1992	3.46	7.30	5.58
1993	1.80	5.07	3.47
1994	2.73	7.30	4.30
1995	3.27	4.74	3.81
1996	3.29	7.54	4.37
1997	2.04	4.03	3.45
1998	3.82	4.81	4.26
1999	4.36	7.54	5.63
2000	4.93	6.05	5.66

Table 2.

CLEMENT POND

HOPKINTON

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
06 / 12 / 1991	TABELLARIA	24
	CHRYSOSPHAERELLA	19
	DINOBRYON	19
07 / 07 / 1992	DINOBRYON	64
	CHRYSOSPHAERELLA	6
	ASTERIONELLA	4
06 / 29 / 1993	TABELLARIA	66
	DINOBRYON	22
06 / 28 / 1994	TABELLARIA	52
	ASTERIONELLA	28
08 / 28 / 1995	TABELLARIA	37
	BLUE-GREEN	28
	MALLOMONAS	4
08 / 27 / 1996	ANABAENA	37
	TABELLARIA	37
	MICROCYSTIS	8
09 / 26 / 1997	APHANIZOMENON	79
	ANABAENA	8
	MICROCYSTIS	4
09 / 25 / 1998	OSCILLATORIA	75
	DINOBRYON	18
	COELOSPHAERIUM	3
09 / 24 / 1999	TABELLARIA	21
	CERATIUM	21
	SYNURA	18
07 / 25 / 2000	ASTERIONELLA	50
	RHIZOSOLENIA	34
	SYNURA	6

Table 3.

CLEMENT POND

HOPKINTON

Summary of current and historical Secchi Disk transparency results (in meters).

Year	Minimum	Maximum	Mean
1991	3.4	3.5	3.4
1992	3.0	4.5	3.7
1993	3.0	4.0	3.3
1994	3.0	4.2	3.6
1995	3.3	5.7	3.9
1996	2.8	4.0	3.2
1997	2.8	5.0	3.7
1998	3.0	5.5	3.8
1999	3.3	5.3	4.0
2000	2.5	3.8	3.3

Table 4.

CLEMENT POND

HOPKINTON

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
EPILIMNION				
	1991	6.91	7.39	7.14
	1992	7.03	7.25	7.13
	1993	6.78	7.34	7.13
	1994	6.93	7.43	7.13
	1995	7.03	7.30	7.14
	1996	6.27	7.18	6.63
	1997	6.85	7.27	7.01
	1998	7.04	7.19	7.13
	1999	6.36	6.99	6.61
	2000	6.93	7.18	7.02
HARDY BK OUTLET				
	1991	7.01	7.15	7.06
	1992	7.03	7.17	7.08
	1993	6.84	7.27	7.00
	1994	6.77	7.09	6.96
	1995	6.96	7.31	7.09
	1996	6.17	6.88	6.53
	1997	6.68	7.06	6.82
	1998	6.90	6.99	6.94
	1999	6.53	6.97	6.81
	2000	6.82	6.99	6.88

Table 4.

CLEMENT POND

HOPKINTON

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
HOPKINTON INLET				
	1991	6.34	6.87	6.49
	1992	6.28	6.45	6.38
	1993	6.21	6.92	6.33
	1994	6.20	6.42	6.29
	1995	6.23	6.59	6.36
	1996	6.17	6.40	6.24
	1997	6.07	6.15	6.11
	1998	6.31	6.41	6.36
	1999	6.28	6.33	6.29
	2000	6.30	6.45	6.37
HYPOLIMNION				
	1991	6.24	6.38	6.30
	1992	6.31	6.57	6.41
	1993	6.35	6.64	6.41
	1994	6.26	7.17	6.42
	1995	6.24	6.87	6.46
	1996	6.18	6.35	6.25
	1997	6.07	6.44	6.23
	1998	6.05	6.36	6.18
	1999	6.21	6.48	6.28
	2000	6.30	6.36	6.32
INLET				
	1995	6.47	6.47	6.47

Table 4.

CLEMENT POND

HOPKINTON

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
METALIMNION				
	1991	6.76	7.34	7.00
	1992	6.78	6.89	6.82
	1993	6.64	7.24	6.97
	1994	6.36	7.04	6.54
	1995	6.62	7.06	6.82
	1996	6.13	6.79	6.35
	1997	6.26	6.90	6.49
	1998	5.99	6.32	6.19
	1999	6.06	6.90	6.34
	2000	6.28	6.38	6.34
OUTLET				
	1995	7.02	7.02	7.02
	1998	6.65	6.65	6.65

Table 5.

CLEMENT POND

HOPKINTON

Summary of current and historical Acid Neutralizing Capacity.
Values expressed in mg/L as CaCO .

Epilimnetic Values

Year	Minimum	Maximum	Mean
1991	8.70	8.90	8.80
1992	8.40	9.20	8.70
1993	8.80	10.30	9.56
1994	5.70	9.20	8.20
1995	6.90	10.10	9.06
1996	6.40	9.10	7.94
1997	7.20	9.10	7.90
1998	7.30	8.80	7.83
1999	6.60	8.80	7.88
2000	7.40	8.50	7.97

Table 6.

CLEMENT POND
HOPKINTON

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
EPILIMNION				
	1991	36.9	38.7	38.0
	1992	38.3	38.5	38.3
	1993	38.1	42.4	40.3
	1994	39.4	42.8	40.9
	1995	39.3	41.9	40.7
	1996	36.5	42.5	40.0
	1997	37.2	38.9	37.8
	1998	34.2	39.3	37.2
	1999	25.9	41.8	37.5
	2000	39.2	41.2	40.3
HARDY BK OUTLET				
	1991	37.1	38.2	37.6
	1992	38.2	39.3	38.6
	1993	38.0	41.7	40.0
	1994	37.4	42.5	39.9
	1995	32.9	41.4	38.6
	1996	38.0	41.3	39.4
	1997	37.4	39.6	38.1
	1998	37.6	38.0	37.8
	1999	39.3	41.9	40.7
	2000	39.3	41.5	40.2
HOPKINTON INLET				
	1991	35.0	39.5	37.3

Table 6.

CLEMENT POND
HOPKINTON

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
	1992	30.9	38.5	34.7
	1993	28.8	46.4	41.1
	1994	35.4	44.4	39.5
	1995	32.0	44.3	39.0
	1996	33.1	40.7	37.3
	1997	30.6	38.7	34.6
	1998	35.9	40.5	38.2
	1999	32.3	46.2	39.0
	2000	35.6	54.6	44.0
HYPOLIMNION				
	1991	37.0	44.7	40.2
	1992	39.8	42.7	41.0
	1993	40.3	44.1	42.0
	1994	41.9	45.1	43.7
	1995	40.3	45.8	42.1
	1996	40.5	45.2	43.7
	1997	39.2	41.3	40.3
	1998	38.8	40.5	39.4
	1999	40.4	82.6	50.2
	2000	42.7	43.7	43.2
INLET				
	1995	38.9	38.9	38.9
METALIMNION				
	1991	37.5	38.7	38.2
	1992	39.4	40.3	39.7

Table 6.

CLEMENT POND
HOPKINTON

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
	1993	38.6	41.4	40.1
	1994	39.2	44.7	42.2
	1995	40.2	43.5	41.5
	1996	38.7	44.5	41.4
	1997	36.9	40.8	38.9
	1998	38.6	41.6	39.6
	1999	26.3	42.0	38.0
	2000	40.7	43.3	41.9
OUTLET				
	1995	42.9	42.9	42.9
	1998	39.1	39.1	39.1

Table 8.

CLEMENT POND

HOPKINTON

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
EPILIMNION				
	1991	8	14	11
	1992	7	11	9
	1993	6	12	9
	1994	9	12	10
	1995	9	11	10
	1996	4	20	11
	1997	5	13	10
	1998	3	10	7
	1999	5	12	8
	2000	7	14	11
HARDY BK OUTLET				
	1991	9	15	11
	1992	11	12	11
	1993	7	15	10
	1994	8	18	12
	1995	3	12	8
	1996	4	11	7
	1997	2	18	10
	1998	6	6	6
	1999	4	10	7
	2000	6	7	6
HOPKINTON INLET				
	1991	26	66	46

Table 8.

CLEMENT POND

HOPKINTON

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
	1992	14	24	19
	1993	22	62	36
	1994	12	26	19
	1995	48	54	51
	1996	4	28	15
	1997	19	20	19
	1998	11	12	11
	1999	17	33	24
	2000	8	20	14
HYPOLIMNION				
	1991	15	44	29
	1992	11	34	21
	1993	10	59	24
	1994	12	22	17
	1995	6	29	16
	1996	5	33	15
	1997	9	22	15
	1998	5	16	10
	1999	11	219	55
	2000	13	27	19
INLET				
	1995	74	74	74
METALIMNION				
	1991	13	20	15
	1992	11	17	14

Table 8.

CLEMENT POND

HOPKINTON

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
	1993	9	16	11
	1994	9	20	13
	1995	9	15	12
	1996	3	12	8
	1997	9	33	15
	1998	5	14	10
	1999	7	19	11
	2000	7	11	9
OUTLET				
	1995	8	8	8
	1998	4	4	4

Table 9.

CLEMENT POND

HOPKINTON

Current year dissolved oxygen and temperature data.

Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
		July 25, 2000	
0.1	23.8	7.7	91.5
1.0	23.4	7.8	91.1
2.0	23.1	7.7	89.7
3.0	22.3	7.2	83.3
4.0	17.2	6.1	63.7
5.0	12.2	3.6	33.9
6.0	10.0	2.5	22.3
7.0	9.0	2.6	22.1
8.0	8.3	2.3	19.7
9.0	7.8	2.1	17.9
10.0	7.4	1.9	15.6
11.0	7.1	1.6	12.9
12.0	6.9	0.9	7.2
13.0	6.7	0.0	-0.2
14.0	6.8	0.0	-0.2

Table 10.

CLEMENT POND

HOPKINTON

Historic Hypolimnetic dissolved oxygen and temperature data.

Date	Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
June 12, 1991	13.0	4.8	1.1	8.6
July 7, 1992	13.0	6.1	0.4	3.2
June 29, 1993	12.0	5.5	1.9	15.0
June 28, 1994	14.0	5.0	0.3	2.0
August 28, 1995	14.5	6.0	0.7	6.0
August 27, 1996	13.5	5.5	0.2	2.0
September 26, 1997	15.0	5.2	0.3	2.0
September 25, 1998	13.0	5.7	0.3	2.0
September 24, 1999	15.0	7.3	1.2	9.2
July 25, 2000	14.0	6.8	0.0	-0.2

Table 11.

CLEMENT POND
HOPKINTON

Summary of current year and historic turbidity sampling.
Results in NTU's.

Station	Year	Minimum	Maximum	Mean
EPILIMNION				
	1997	0.3	0.4	0.4
	1998	0.4	0.6	0.5
	1999	0.3	1.2	0.6
	2000	0.3	0.4	0.3
HARDY BK OUTLET				
	1997	0.3	0.5	0.3
	1998	0.3	0.3	0.3
	1999	0.2	0.5	0.4
	2000	0.3	0.6	0.4
HOPKINTON INLET				
	1997	0.2	0.4	0.3
	1998	0.5	0.6	0.5
	1999	0.4	1.1	0.6
	2000	0.3	0.7	0.5
HYPOLIMNION				
	1997	0.5	2.0	1.3
	1998	0.2	3.1	1.1
	1999	0.5	3.2	1.7
	2000	2.5	3.0	2.7
METALIMNION				
	1997	0.4	0.9	0.5
	1998	0.4	2.1	1.1
	1999	0.4	1.1	0.8
	2000	0.3	0.7	0.5

Table 11.

CLEMENT POND

HOPKINTON

Summary of current year and historic turbidity sampling.
Results in NTU's.

Station	Year	Minimum	Maximum	Mean
OUTLET				
	1998	0.3	0.3	0.3